



**Pacific Gas and
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December 31, 1998

PG&E Letter DCL-98-186

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555

Docket No. 50-323, OL-DPR-82
Diablo Canyon Unit 2

Licensee Event Report 2-1998-005-00

Manual Reactor Trip Due to Heavy Debris Loading of the Circulating Water
System During a Pacific Ocean Storm

Dear Commissioners and Staff:

Pursuant to 10 CFR 50.73(a)(2)(iv), PG&E is submitting the enclosed licensee event report regarding a manual reactor trip due to heavy debris loading of the circulating water system during a Pacific Ocean storm.

This event did not adversely affect the health and safety of the public.

Sincerely,



For DHO

David H. Oatley

cc: Steven D. Bloom
Ellis W. Merschoff
David L. Proulx
Linda J. Smith
Diablo Distribution
INPO

Enclosure

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LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)

Diablo Canyon Unit 2

DOCKET NUMBER (2)

0 5 0 0 0 3 2 3 1 OF 10

PAGE (3)

TITLE (4)

Manual Reactor Trip Due to Heavy Debris Loading of the Circulating Water System During a Pacific Ocean Storm

EVENT DATE (5)

LER NUMBER (6)

REPORT DATE (7)

OTHER FACILITIES INVOLVED (8)

MO

DAY

YEAR

YEAR

SEQUENTIAL NUMBER

REVISION NUMBER

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DAY

YEAR

FACILITY NAME

DOCKET NUMBER

12

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1998

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1998

OPERATING MODE (9)

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR: (11)

1

X

10 CFR

50.73(a)(2)(iv)

POWER LEVEL (10)

OTHER

1

0

0

(SPECIFY IN ABSTRACT BELOW AND IN TEXT, NRC FORM 386A)

LICENSEE CONTACT FOR THIS LER (12)

TELEPHONE NUMBER

AREA CODE

Roger L. Russell - Senior Regulatory Services Engineer

805

545-4327

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE

SYSTEM

COMPONENT

MANUFACTURER

REPORTABLE TO EPIX

CAUSE

SYSTEM

COMPONENT

MANUFACTURER

REPORTABLE TO EPIX

SUPPLEMENTAL REPORT EXPECTED (14)

EXPECTED

MON

OAY

YR

[] YES (If yes, complete EXPECTED SUBMISSION DATE)

[X] NO

SUBMISSION DATE (15)

ABSTRACT (Limit to 1400 spaces i.e., approximately 15 single-spaced typewritten lines.) (16)

On December 1, 1998, at 0347 PST, with Units 1 and 2 in Mode 1 (Power Operation) at approximately 100 percent power, plant operators initiated a Unit 2 manual reactor trip due to sudden heavy debris loading of the main circulating water systems during a Pacific Ocean storm. Unit 1 power was reduced to 50 percent to control debris loading. Unit 2 was stabilized in Mode 3 (Hot Standby) in accordance with plant emergency procedures. A 4-hour, non-emergency report was made to the NRC at 0529 PST in accordance with 10 CFR 50.72(b)(2)(ii).

The cause of the event was sudden heavy debris loading on the circulating water system traveling screens during a period of high seas that dislodged plant life from the ocean bottom.

PG&E cannot prevent the potential need to expedite manual reactor trips when high seas and dislodged plant life result in sudden heavy debris loading on the traveling screens. However, enhancements will be made to operating orders for storm conditions, improvements to circulating water system indication reliability in the control room, enhancement to shift turnover guidance, and additional operator training to include the lessons learned from this event.

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TEXT

I. Plant Conditions

Unit 2 was in Mode 1 (Power Operation) at 100 percent power.

II. Description of Problem

A. Summary

On December 1, 1998, at 0347 PST, with Units 1 and 2 in Mode 1 at approximately 100 percent power, plant operators initiated a Unit 2 manual reactor trip due to sudden heavy debris loading of the circulating water systems during a Pacific Ocean storm. Unit 1 power was reduced to 50 percent to control debris loading. Unit 2 was stabilized in Mode 3 (Hot Standby) in accordance with plant emergency procedures. A 4-hour, non-emergency report was made to the NRC at 0529 PST in accordance with 10 CFR 50.72(b)(2)(ii).

B. Background

The circulating water system provides Pacific Ocean saltwater cooling supply to the main condenser (KE), condensate cooler (KE)(HX), service water cooling system (BI), and intake cooling system (KE). The saltwater enters the cooling water intake structure by passing through bar racks (RK) and then through traveling screen (SCN) assemblies. Each Unit has two single-stage circulating water pumps (CWPs)(P) and each CWP has three traveling screens. The bar racks and traveling screens reduce the amount of floating debris and sea life entering the system and restricting flow through the main condenser.

The screens for the CWPs are operated either in manual or automatic mode. In manual mode, the screens can be operated in slow or high speed.

"Operating Order O-28: Intake Management," establishes management expectations for operation of the seawater cooling intake system during heavy storm conditions. O-28 provides coping strategies during storm warning conditions and considerations regarding minimizing equipment damage during heavy Pacific Ocean storms that may overwhelm debris removal capabilities.

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TEXT

Operating Procedure OP AP-7, "Degraded Condenser," provides instructions for operators to respond to a loss of condenser vacuum, condenser cooling water flow fouling, and traveling screen problems. Using the differential pressure (dp) measured across the traveling screens, the procedure identifies when to secure a CWP and when to manually trip the reactor to prevent excessive damage to the traveling screens.

C. Event Description

On November 30, 1998, at 1253 PST, a high swell warning was issued by the PG&E biofouling group effective November 30, 1998, at 2000 PST.

On November 30, 1998, at 1717 PST, the Unit 1 intake cooling system debris grinder was removed from service for transfer to Unit 2 due to anticipated heavier debris loading of Unit 2.

On November 30, 1998, at 1930 PST, plant operators, assuming the night watch, received a tailboard regarding Operating Order 0-28 and OP AP-7.

On November 30, 1998, at 2000 PST, the high Pacific Ocean swell warning went into effect.

On November 30, 1998, at 2025 PST, the relocated Unit 1 debris grinder was placed in service in Unit 2.

On December 1, 1998, at 0114 PST, the Unit 2 CWP traveling screen dp high autostart alarm was received. The alarm was cleared at 0128 PST.

On December 1, 1998, at 0137 PST, the Unit 2 debris grinder was removed from service for approximately 30 minutes to remove debris accumulation.

On December 1, 1998, at 0140 PST, the Unit 2 main condenser high dp rate alarm was received with dp greater than 7 psid. This alarm was received and cleared seven times in the following 2 hours.

On December 1, 1998, at 0300 PST, the Unit 2 east condenser dp increased to 8 psid. Plant operators decided that at 9 psid the Unit would be ramped to 50 percent power to stop CWP 2-1 and manually clean the east condenser.

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TEXT

On December 1, 1998, at 0324 PST, the Unit 2 main condenser east half high dp rate alarm was again received.

On December 1, 1998, at 0328 PST, the Unit 2 traveling screen high dp high-autostart in high speed alarm was received.

On December 1, 1998, at 0335 PST, the Unit 2 traveling screen high dp high or screen not in motion alarm was received.

On December 1, 1998, at 0343 PST, the Unit 2 traveling screen high dp alarm cleared.

On December 1, 1998, at 0345 PST, the Unit 2 traveling screen dp high autostart screen in high speed alarm was received.

On December 1, 1998, at 0347 PST, CWP 2-2 traveling screen dp was observed rapidly increasing from 30-40 inches to greater than 90 inches. Plant operators initiated a Unit 2 rapid decrease in main generator load.

On December 1, 1998, at 0347 PST, plant operators initiated a manual reactor trip to prevent equipment damage as CWP traveling screen dp increased over 100 inches. As designed, the 40 percent steam dump valves opened to the main condenser.

On December 1, 1998, at 0348 PST, a Unit trip signal was automatically initiated and plant power was transferred to the 230 kV startup system. During the power transfer, Diesel Generator (DG) 2-2 autostarted from a bus H undervoltage signal. As designed, DG 2-2 did not load. CWP 2-1 automatically shut down during the power transfer because it was not selected for auto-reclosure on bus transfer. Approximately 5 minutes later, plant operators shut down CWP 2-2 due to control room observations of motor amperage swings. The main condenser was no longer available; therefore, reactor cooling was transferred to the 10 percent atmospheric dump valves (ADV) which were set at approximately 1005 psig.

On December 1, 1998, at 0400 PST, Unit 1 power was reduced to approximately 50 percent and CWP 1-2 was removed from service to investigate the traveling screens associated with CWP 1-2.

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TEXT

On December 1, 1998, at 0414 PST, plant operators confirmed that offsite power was available to bus H and shut down DG 2-2. Plant operators raised the 10 percent ADV setpoint to approximately 1035 psig to reduce primary system cooldown effects.

On December 1, 1998, at 0417 PST, the Steam Generator (SG) 2-2 lowest set pressure main steam safety valve (MSSV)(RV-7), and SG 2-1 10 percent ADV (PCV-19) opened on increasing pressure at approximately 1035 psig.

On December 1, 1998, at approximately 0439 PST, the reactor coolant system was stabilized in Mode 3 at normal operating temperature and pressure.

On December 1, 1998, at 0529 PST, a 4-hour, non-emergency report was made in accordance with 10 CFR 50.72(b)(2)(ii).

On December 1, 1998, at 0530 PST, plant operators identified that SG 2-2 was receiving significantly more auxiliary feedwater flow than the other three SGs. Investigation determined that additional feedwater flow was being provided because RV-7 had not fully reseated.

On December 1, 1998, at 0800 PST, main steam pressure was manually reduced to reseal RV-7. The valve was successfully closed at 0819 PST at approximately 980 psig main steam pressure.

D. Inoperable Structures, Components, or Systems that Contributed to the Event

None.

E. Dates and Approximate Times for Major Occurrences

1. November 30, 1998, at 2000 PST: Pacific Ocean high swell warning went into effect.
2. December 1, 1998, at 0347 PST: Plant operators initiated a fast turbine load reduction and a manual reactor trip.

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TEXT

3. December 1, 1998, at 0414 PST: Plant operators confirmed that offsite power was available to bus H and shut down DG 2-2.
4. December 1, 1998, at 0439 PST: Unit 2 was stabilized in Mode 3.
5. December 1, 1998, at 0529 PST: A 4-hour, non-emergency report was made in accordance with 10 CFR 50.72(b)(2)(ii).
6. December 1, 1998, at 0819 PST: RV-7 was closed.

F. Other Systems or Secondary Functions Affected

None.

G. Method of Discovery

The event was immediately apparent to plant operators due to alarms and indications received in the control room.

H. Operator Actions

Licensed plant operators in the control room responded in accordance with established emergency procedures. They confirmed the reactor trip, verified proper engineered safety feature actuations, closed the main steam isolation valves to prevent excessive cooldown, and initiated other manual actions to stabilize the Unit in Mode 3.

I. Safety System Responses

1. The reactor trip breakers (JC)(BKR) opened.
2. The main turbine (TA)(TRB) tripped.
3. The control rod drive mechanism (AA)(DRIV) allowed the control rods to drop into the core.
4. The motor driven auxiliary feedwater pumps (BA)(P) started.
5. The containment fan coolers (EK)(FAN) started.

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TEXT

6. DG 2-2 started but did not load to the 4 kV bus.
7. Immediately after the manual trip, the 40 percent steam dump valves automatically opened and relieved SG pressure to the condenser. After the CWPs were secured, the four 10 percent ADVs were manually adjusted to control at 1005 psig to relieve SG pressure to the atmosphere. Subsequently, plant operators returned the ADV setpoints to the normal setting of 1035 psig to reduce primary system cooling effects. This action caused MSSV RV-7 to partially open. RV-7 continued to relieve pressure until main steam pressure was manually reduced to approximately 980 psig.

III. Cause of the Problem

A. Immediate Cause

Unit 2 was manually tripped to prevent damage to the traveling screens due to sudden heavy debris loading of the main circulating water system.

B. Root Cause

The root cause of the event was sudden heavy debris loading on the circulating water system traveling screens during a period of high seas that dislodged plant life from the ocean bottom.

C. Contributory Cause

Plant operators in the control room manually adjusted the 10 percent ADV setpoint from 1005 psig to 1035 psig to reduce the primary system cooldown effects. This action resulted in the premature lift of RV-7 due to inconsistent guidance between emergency and abnormal operating procedures.

IV. Analysis of the Event

A manual reactor trip from 100 percent power is a previously analyzed Final Safety Analysis Report Update, Chapter 15, Condition II event. The 10 percent ADVs and the pressurizer controlled the reactor coolant temperature and

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TEXT

pressure in accordance with plant design basis. Therefore, the health and safety of the public were not adversely affected by this event.

V. Corrective Actions

A. Immediate Corrective Actions

1. MSSV RV-7 was adjusted and satisfactorily tested in accordance with plant procedures. Two additional MSSVs were satisfactorily tested without adjustment in accordance with procedures.
2. An event summary and lessons learned document was prepared and issued for review by plant operators.

B. Corrective Actions to Prevent Recurrence

PG&E cannot entirely eliminate the potential need to expedite manual reactor trips when high seas and dislodged plant life from the ocean bottom result in heavy debris loading on the traveling screens. However, the following near-term actions incorporate the lessons learned from the event and will reduce overall plant impact and damage to equipment.

1. PG&E will enhance OP 0-28, "Operating Order 0-28: Intake Management," to include the lessons learned from this event regarding heavy weather coping strategy. The guidance will include a Plant Staff Review Committee review of Category 2 storm warning conditions.
2. PG&E will enhance operating crew expectations regarding tailboards for storm warning conditions.
3. PG&E will develop and provide operator training regarding equipment damage mitigation (coping strategy).
4. PG&E will review the circulating water system indications in the control room and develop enhancements based on that review.
5. PG&E will develop and implement an Operations section policy regarding the determination and analysis of operator actions and plant response during off normal events.

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TEXT

6. PG&E will investigate and modify emergency operating procedure and/or abnormal operating procedure instructions regarding ADV setting and operation.
7. PG&E will review the annunciator alarm response procedure, abnormal operating procedure (AP-7), and operating order (0-28), to ensure there is consistency of direction.

VI. Additional Information

A. Failed Components

One of two circulating water system screen wash system debris grinders was out of service during the event; however, this equipment would not have prevented the sudden heavy debris buildup on the screens.

During subsequent recovery operation, two seawater cooling system synthetic expansion joints failed in nonsafety related saltwater cooling systems in the intake structure. All synthetic expansion joints were inspected or replaced prior to resumption of full power operation of both Units 1 and 2.

B. Previous Similar Events

LER 1-95-017-00, "Manual Reactor Trip Due to Heavy Loading of Traveling Screens." On December 13, 1995, plant operators initiated a manual reactor trip due to heavy swells from a major Pacific storm. Additional screen rakes were added to the traveling screens to improve debris removal efficiency and plant operator training was provided. The additional screen rakes would not have precluded this event due to the sudden magnitude of the buildup.

LER 2-94-012-00, "Manual Reactor Trip Due to Circulating Water Pump Cavitation as a Result of Intake Screen Fouling." On December 19, 1994, a manual Unit 2 trip was initiated due to CWP cavitation due to intake screen fouling. Most of the corrective actions for the LER were focused on minimizing condenser fouling. Therefore, the corrective actions would not have prevented this event involving traveling screen fouling.

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LER 2-95-002-00, "Manual Reactor Trip Due to Heavy Debris Loading and Damage to Traveling Screens." On September 23, 1995, plant operators initiated a manual Unit 2 reactor trip when the traveling screens stopped running due to debris loading. Corrective actions for this event included installation of new kelp rakes and revision of OP AP-7 to reduce or prevent damage to the traveling screens. The new kelp rakes had not been installed prior to the event; however, an evaluation determined that even with the kelp rakes this event would not have been prevented.

CATEGORY 1

REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)

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AUTH.NAME , AUTHOR AFFILIATION
RUSSELL,R.L. Pacific Gas & Electric Co.
OATLEY,D.H. Pacific Gas & Electric Co.
RECIP.NAME RECIPIENT AFFILIATION

SUBJECT: LER 98-005-01:on 981201,manual reactor trip was initiated due
to sudden heavy debris loading on CWS traveling screens.
Licensee will enhance OP 0-28, "Operating Order 0-28:Intake
Mgt," to include lessons learned from event.With 981231 ltr.

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